working for clean rivers

Survival and growth of Pacific madrone following four years of establishment care

Lea Wilson, Environmental Technician
City of Portland Environmental Services

March 1, 2021

ENVIRONMENTAL SERVICES
CITY OF PORTLAND

working for clean rivers

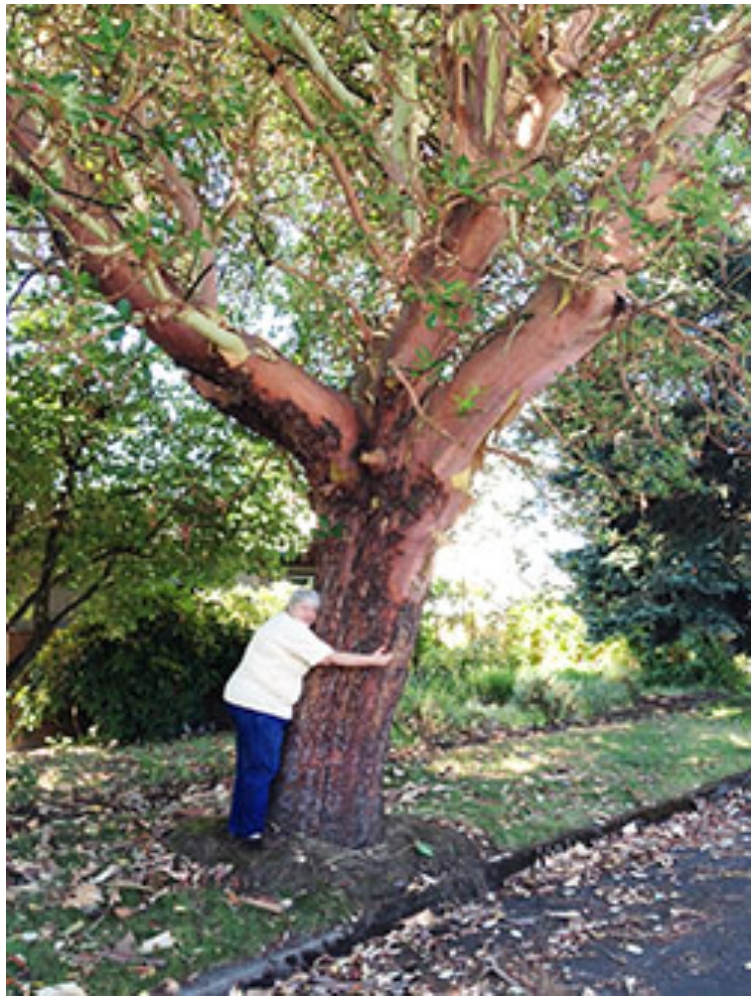
MINGUS MAPPS, COMMISSIONER • MICHAEL JORDAN, DIRECTOR

A little context

The Environmental Services Tree Program plants trees in partnership with Portlanders for stormwater management and watershed health.

madrone

- Charismatic organism
- Only native broadleaf evergreen tree
- Reputation for being “tough”
- Reputation for being difficult to transplant



Heritage Tree #324, photo Portland Parks & Recreation

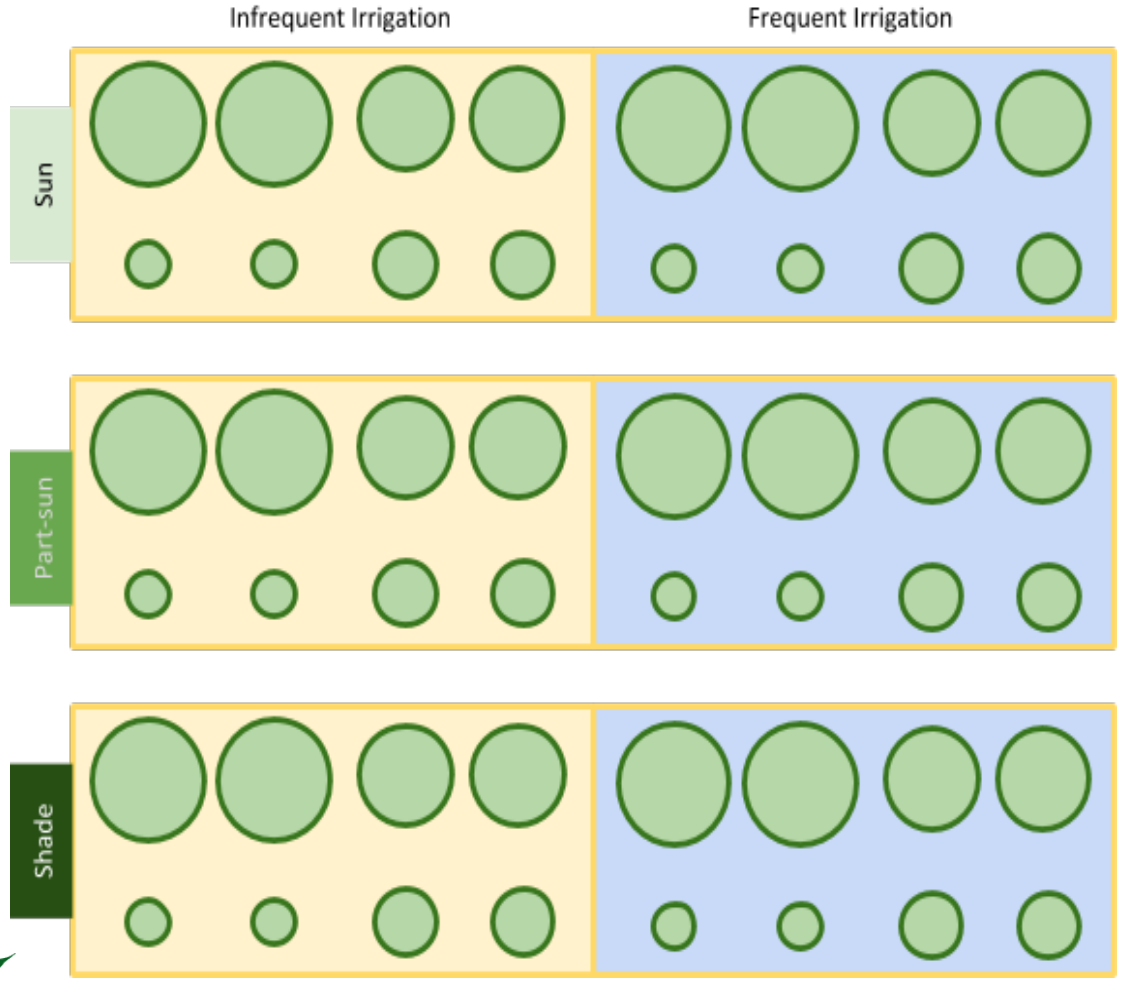
Advice from a local nursery

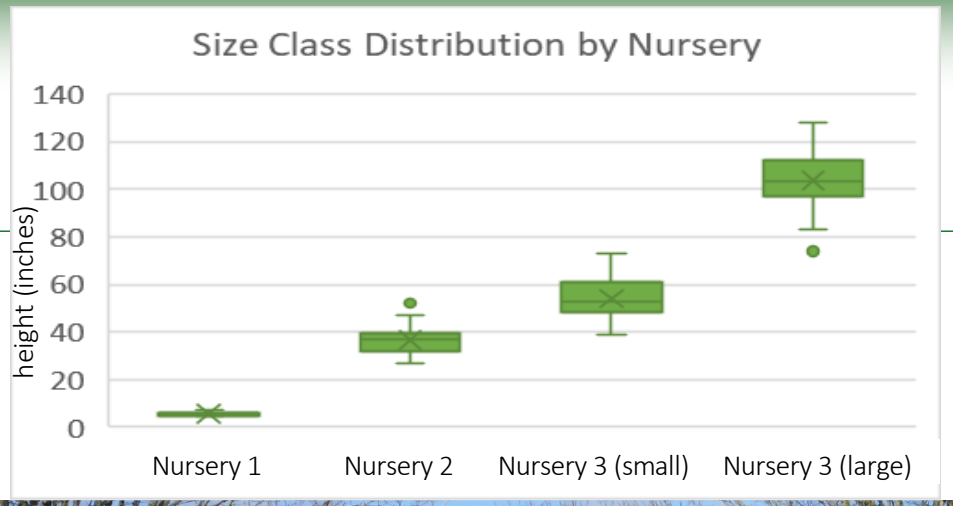
"There is much to love and admire about the Arbutus, and it is truly no wonder gardeners are ***willing to take on the challenges*** *of growing it! It is no accident that Arbutus menziesii is found growing on dry, rocky slopes and bluffs -* ***this tree is fairly adamant about having relatively poor soil and superb drainage****. Typical garden irrigation usually provides more water than they want or need – a little* ***benign neglect in a dry part of the garden*** *once the tree is established will suit it just fine….Madrones tend to be slow growing –* ***slower still if receiving too much water****, especially at the beginning – and unfortunately the situation can't be gotten around by starting off with a larger plant,* ***because larger trees have a more difficult time in transplanting*** *and getting established."*

Questions

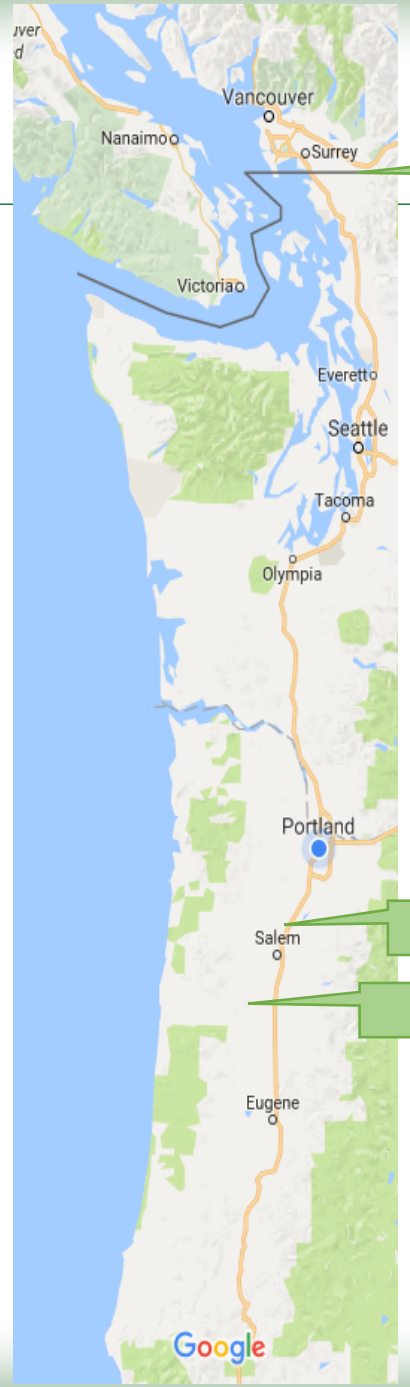
1. Does smaller size-at-planting increase survival or growth?
2. Do trees planted in full sun have a higher survival rate or grow more than trees planted in shadier conditions?
3. Are trees with infrequent irrigation following planting more likely to survive or grow more than those that receive regular water?

Study Design





Confounding Variables

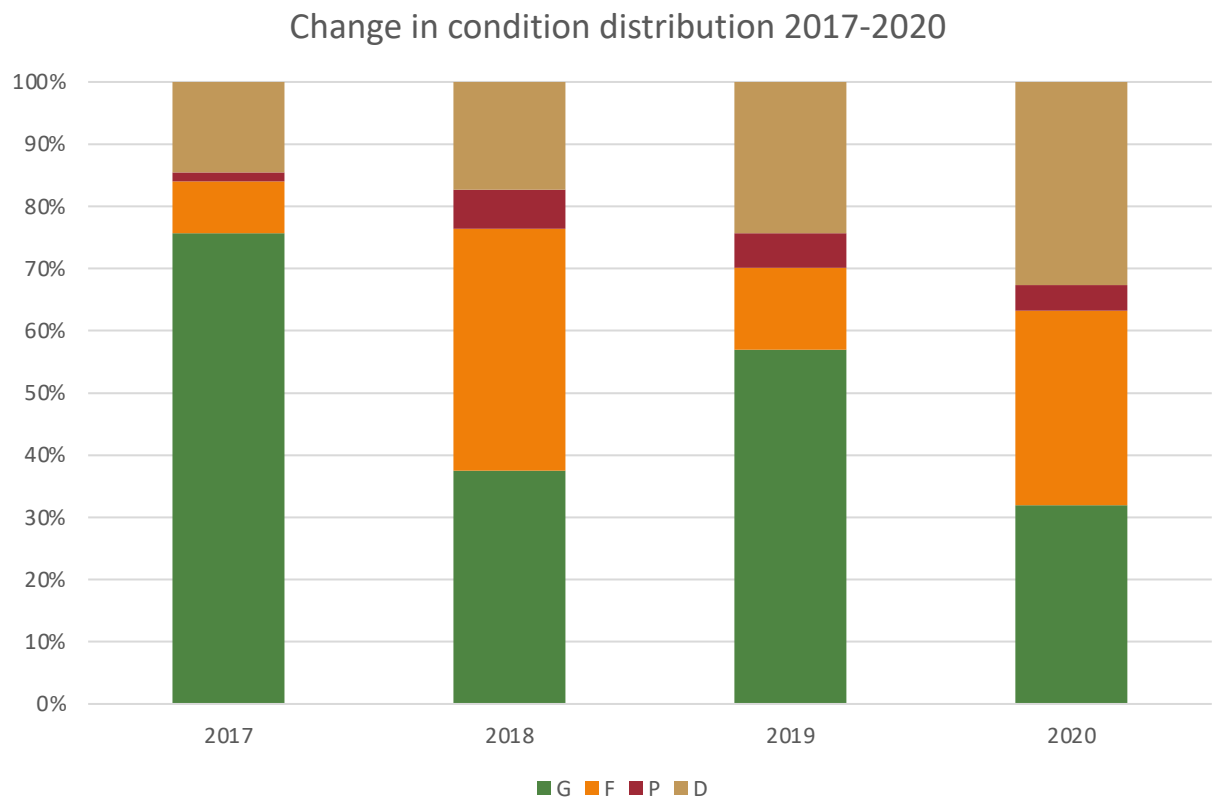


Nursery 3

Nursery 2

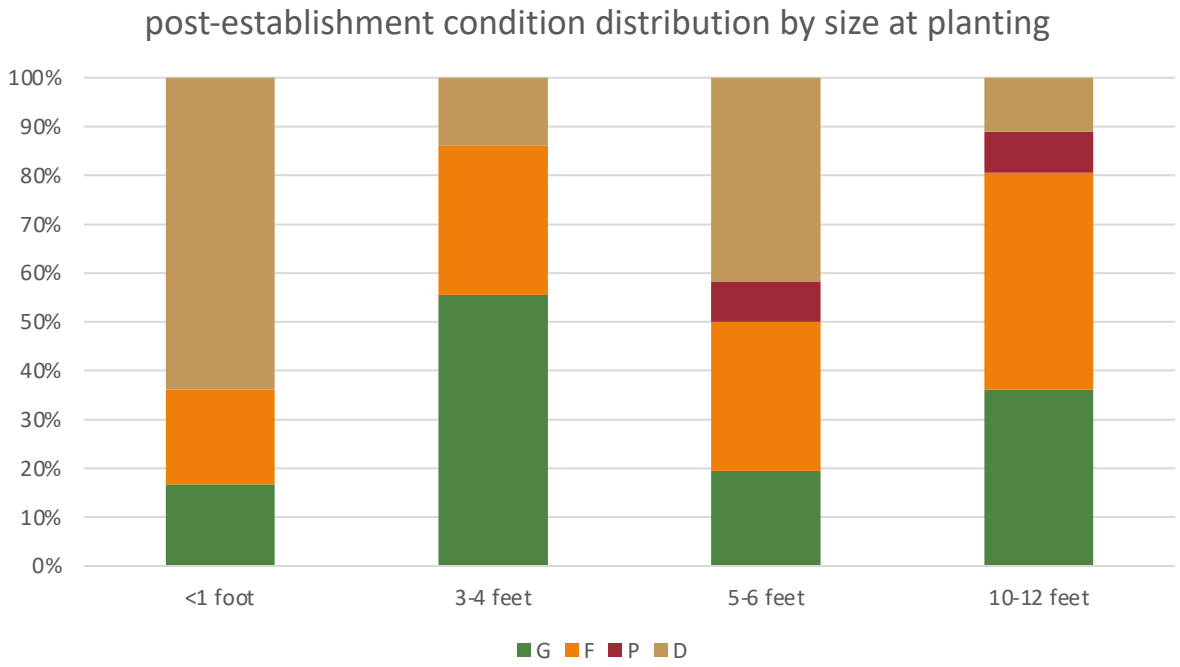
Nursery 1

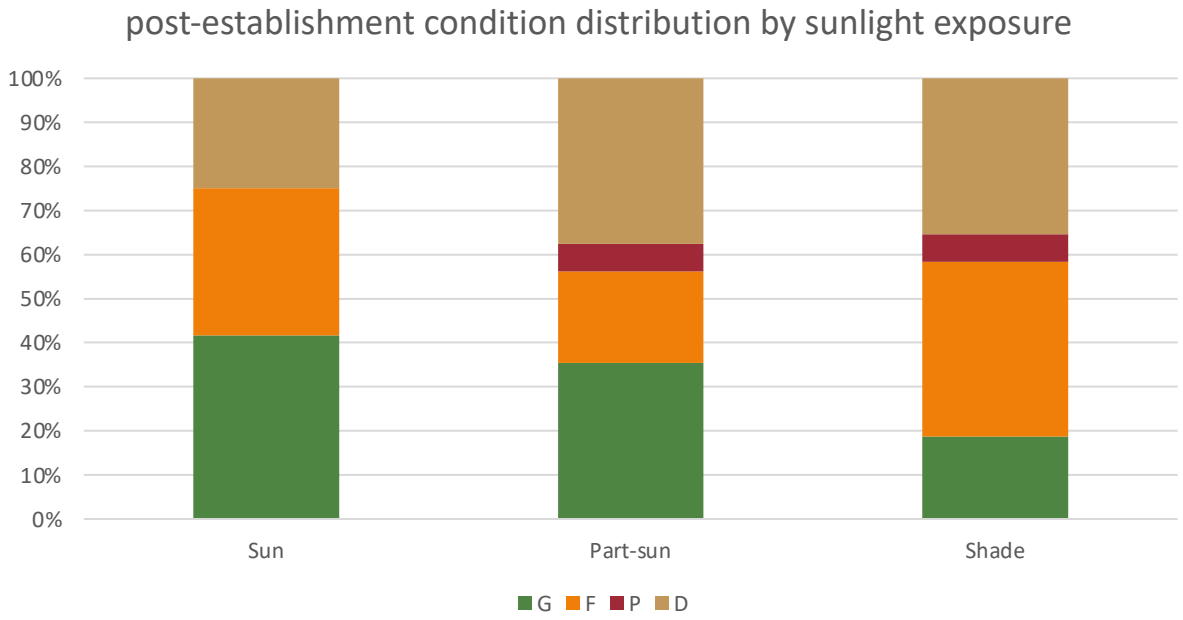
Overall Survival



Which trees survived?

Full sun does seem to be better.
Kruskal-Wallis chi-squared = 29.582,
p-value = 3.771e-07



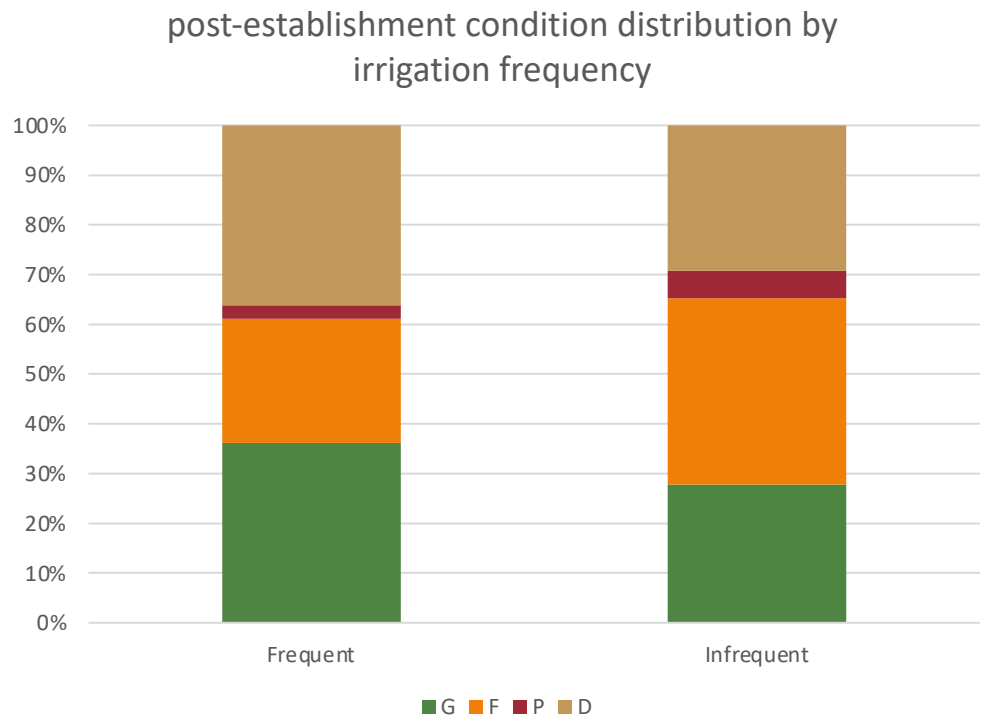


Size at planting mattered, too…but smaller wasn't better.
Kruskal-Wallis chi-squared = 95.117,
p-value <2.2e-16

Which trees survived? (cont)

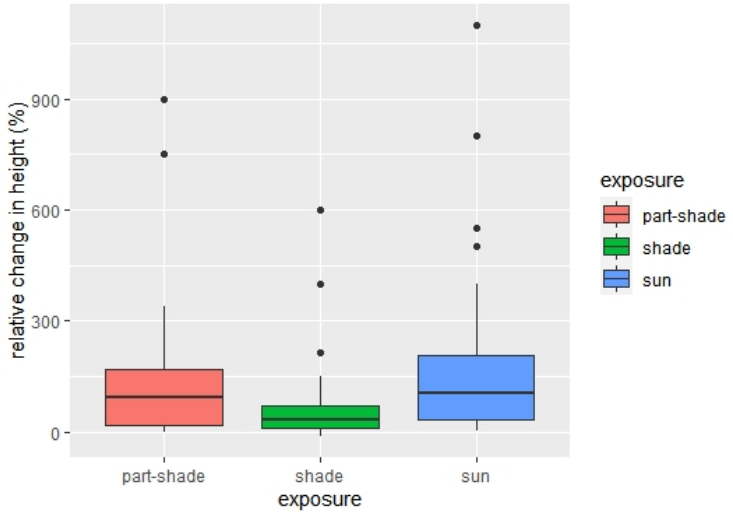
Irrigation did not impact survival

Kruskal-Wallis chi-squared = 2.4305, p-value = 0.119

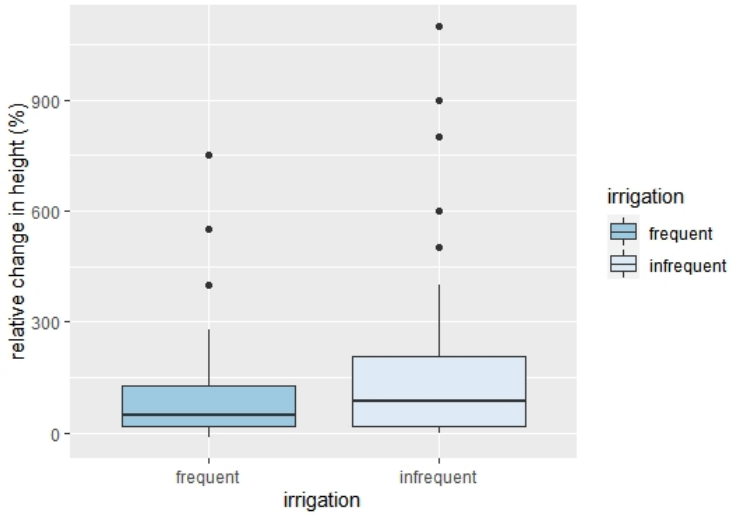


What about growth (height)?

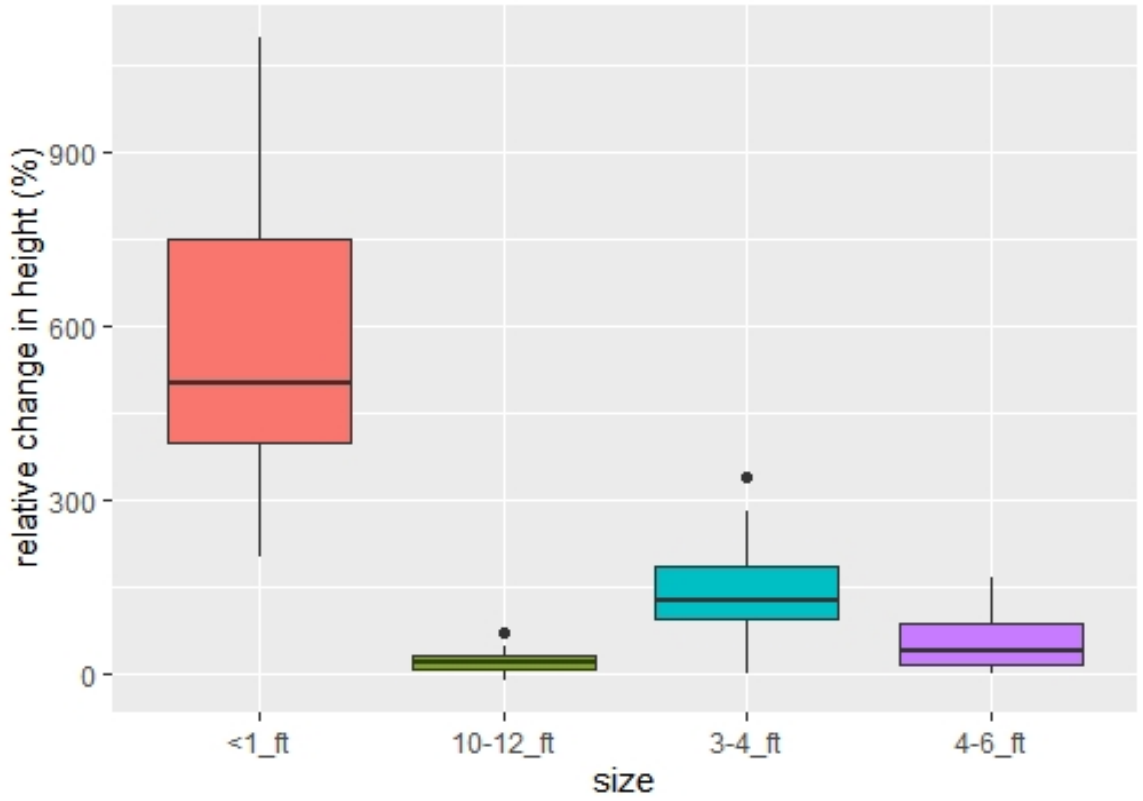
One-way ANOVA
F = 2.524 p = 0.0856



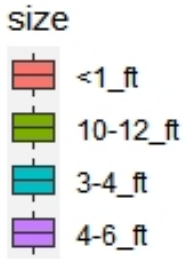
One-way ANOVA
F = 2.246, p = 0.137



What about growth (height)? (cont)



size	count
<1_ft	13
3-4_ft	31
4-6_ft	21
10-12_ft	32



One-way ANOVA
F = 75.34, p < 2E-16

```
  Tukey multiple comparisons of means
    95% family-wise confidence level

Fit: aov(formula = Relative_ch_ht ~ size, data = Baltimore_madrones_DATA)

$size
                          diff        lwr         upr     p adj
10-12_ft-<1_ft   -5.3048384 -6.2630456 -4.34663129 0.0000000
3-4_ft-<1_ft     -4.1130568 -5.0757184 -3.15039527 0.0000000
4-6_ft-<1_ft     -4.9576470 -5.9858005 -3.92949349 0.0000000
3-4_ft-10-12_ft   1.1917816  0.4575818  1.92598140 0.0002963
4-6_ft-10-12_ft   0.3471915 -0.4709966  1.16537948 0.6842398
4-6_ft-3-4_ft    -0.8445901 -1.6679904 -0.02118989 0.0421486
```

Summary

- 3-4 feet sweet spot for survival, growth, and cost
- Choose a nice sunny spot
- No special instructions for irrigation
- Bark damage?

Thank you

Contact: lea.wilson@portlandoregon.gov

Special thanks to the BES watershed revegetation team, the PP&R land stewardship team, and the Friends of Baltimore Woods for sharing this wonderful site with us.

Shout-out to our contractor Treecology for the planting and establishment services.

Interested in learning more about madrone? Join the ARME: https://www.arbutusarme.org/